

WHAT IS CLAIMED IS:

1. A polymer electrolyte fuel cell comprising:
 - 5 a plurality of unit cells each having a proton exchange membrane, a fuel electrode provided on one surface of the membrane and having a catalyst layer, and an oxidizer electrode provided on the other surface of the membrane and having a catalyst layer;
 - 10 a reactant-gas supplying separator having reactant gas supplying passages for supplying reactant gas to the fuel electrode and oxidizer electrode of each unit cell;
 - 15 a water manifold passing through the reactant gas supplying separator; and
 - 20 water-supplying means for supplying water in liquid state to the reactant gas supplying passages provided in at least one of the fuel electrode and oxidizer electrode, said water-supplying means comprising a header which is provided in a reactant gas inlet section provided in the reactant gas supplying separator and which mixes reactant gas with water, and a water-supplying groove which is made in the same surface of the reactant gas supplying separator as the reactant gas supplying passages and which connects the header and the water manifold.
- 25 2. The polymer electrolyte fuel cell according to claim 1, comprising: a plurality of unit cells each having proton exchange membrane, a fuel electrode

provided on one surface of the membrane and having a catalyst layer, and an oxidizer electrode provided on the other surface of the membrane and having a catalyst layer; a reactant gas supplying separator
5 having fuel-gas supplying passages for supplying reactant gas to the fuel electrode to the fuel electrode and oxidizer electrode of each unit cell; a water manifold which passes through at least the reactant-gas supplying separator, water-supplying
10 means for supplying water in liquid state to reactant gas supplying passages which are made in at least one of the fuel electrode and oxidizer electrode, said water-supplying means comprising a header which is provided in a reactant-gas inlet section provided in
15 the reactant-gas supplying separator and which mixes reactant-gas with water, a water-supplying groove which is made in the same surface as the reactant gas supplying passages and which connects the header and the water manifold, and a porous member; a water-
20 supplying groove which is made in the same surface as the reactant gas supplying passages and which connects the header and the water manifold, and; a porous member which is arranged in the water-supplying groove and which has an average pore diameter of 20 m or less
25 (excluding 0 mm).

3. A power-generating system with polymer electrolyte fuel cells, comprising:

a plurality of unit cells each having a proton exchange membrane, a fuel electrode provided on one surface of the membrane and having a catalyst layer, and an oxidizer electrode provided on the other surface of the membrane and having a catalyst layer;

5 a reactant-gas supplying separator having reactant gas supplying passages for supplying reactant gas to the fuel electrode and oxidizing electrode of each unit cell;

10 a water manifold which passes through the reactant gas supplying separator; and

water-supplying means for supplying water in liquid state to the reactant gas supplying passages made in at least one of the fuel electrode and 15 oxidizer electrode;

heat-recovering means for recovering heat of water from exhausted fuel gas and oxidizer exhaust gas which are discharged from the unit cells;

20 recovered-water supplying means for supplying the water recovered in the heat-recovering means; and

water-amount control means for controlling an amount of water supplied from the recovered-water supplying means.

4. A power-generating system with polymer electrolyte fuel cells, comprising: a plurality of unit cells, each having proton exchange membrane, a fuel electrode provided on one surface of the membrane

and having a catalyst layer, and an oxidizer electrode provided on the other surface of the membrane and having a catalyst layer; a reactant gas supplying separator having reactant gas supplying passages for supplying reactant gases to the fuel electrode and oxidizing electrode of each unit cell; a water manifold which passes through the reactant gas supplying separator; water-supplying means for supplying water in liquid state to the reactant gas supplying passages made in at least one of the fuel electrode and oxidizer electrode; heat-recovering means for recovering heat of water from exhausted fuel gas and exhausted oxidizer gas which are discharged from the unit cells; recovered-water supplying means for supplying the water recovered in the heat-recovering means to the unit cells; and water-amount control means for controlling an amount of water supplied from the recovered water supplying means, wherein calculation means for calculating an amount of water to be supplied, from the voltage of electric power generated by each unit cell and the load current of each unit cell, and a metering pump which controls the amount of the recovered water to be supplied, in accordance with a signal representing the result of calculation performed by the calculation means.

5. A power-generating system with polymer electrolyte fuel cells, comprising: a plurality of

unit cells, each having proton exchange membrane, a
fuel electrode provided on one surface of the membrane
and having a catalyst layer, and an oxidizer electrode
provided on the other surface of the membrane and
5 having a catalyst layer; a reactant gas supplying
separator having reactant gas supplying passages for
supplying reactant gases to the fuel electrode and
oxidizing electrode of each unit cell; a water
manifold which passes through the reactant gas
10 supplying separator; water-supplying means for
supplying water in liquid state to the reactant gas
supplying passages made in at least one of the fuel
electrode and oxidizer electrode; heat-recovering
means for recovering heat of water from exhausted fuel
15 gas and exhausted oxidizer gas which are discharged
from the unit cells; recovered-water supplying means
for supplying the water recovered in the heat-
recovering means to the unit cells; and water-amount
control means for controlling an amount of water
20 supplied from the recovered water supplying means,
said water-amount control means comprising calculation
means which calculates an amount of water to supply,
from the voltage of electric power generated by each
unit cell and the load current of each unit cell,
25 wherein the calculation means calculates the amount W
of water (g/min) in accordance with the following
equation, and the water-amount control means controls

the supply of water to the fuel-gas supplying passages or oxidizer-gas supplying passages, in an amount up to 20 times the value W ,

$$W = 30 \cdot I \cdot C \cdot (\Delta H / F - 2V) / h \quad (1)$$

5 where V is the voltage of electric power (V/cell), I is the load current (A), C is the number of basic units stacked, h is the latent heat of evaporation (J/g), ΔH is the enthalpy change (J/mol) that occurs when water the cell reaction generates water vapor, and F is the
10 Faraday constant (C/mol).